Chapter 14
Performance Analysis of Traffic and Mobility Models on Mobile and Vehicular Ad Hoc Wireless Networks

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ABSTRACT

Advances in wireless communication technology and the proliferation of mobile devices enable the capabilities of communicating with each other even in areas with no pre-existing communication infrastructure. Traffic and mobility models play an important role in evaluating the performance of these communication networks. Despite criticism and assumption from various researches on Transmission Control Protocols (TCP), weaknesses on Mobile Ad Hoc Network (MANET), and Vehicular Ad Hoc Network (VANET). A simulation was carried out to evaluate the performance of Constant Bit Rate, Variable Bit Rate and Transmission Control Protocol on MANET and VANET using DSR routing protocol. CBR, VBR, and TCP have different manufacturer operation mechanisms and these differences lead to significant performance of CBR and VBR over TCP with better throughput and less average maximal end-to-end delay. DSR was able to respond to link failure at low mobility which led to TCP's performance in packets delivery.

INTRODUCTION

Mobile Ad Hoc and vehicular ad hoc networks plays a vital role within the field of network communication. The recent developments in wireless technologies have made Vehicle-to-Vehicle communication (V2V) and Roadside Unit (RSU) achievable in mobile ad hoc networks. This has given birth and brought a new concept of Mobile Ad Hoc Wireless Network known as the vehicular ad hoc network. Vehicular Ad hoc Networks are self-organizing communities of wheeled mobile units consisting of large number of vehicles and a small number of fixed infrastructure nodes

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such as roadside access units within radio communication range to each other. The initiative behind VANET is to facilitate road safety, traffic management and infotainment dissemination for drivers and passengers. In a domain which lacks communication infrastructure or where the existing infrastructure is inconvenient to use, mobile users can communicate through the formation of a temporary wireless Mobile Ad hoc Network. The nodes are mobile and free to move propagating packets freely and randomly without the need for any infrastructure. The application of these networks are highly needed in areas like battlefields, emergency rescue services, lecture theatres conference halls and other places where deployment of network infrastructures becomes difficult.

Due to the fact that their topology/location changes rapidly and unpredictably, these networks need network routing protocol as well as traffic model that can withstand these unpredicted topological changes immediately. These protocols are categorised into pro-active, reactive and hybrid routing protocols (Qasim *et al.,* 2009) and the identification of the most appropriate routing protocol to be used depends on different factors, namely: a) traffic and mobility models b) scalability and c) quality of service.

Despite the fact that considerable simulation work has been done, still more investigation is needed to evaluate the performance of the traffic and mobility models on MANET, VANET and comparison between them. Most of the researches such as (Rajagopalan *et al.,* 2006) evaluate only the performance of TCP traffic model using AODV routing protocol without considering the DSR protocol with CBR, TCP or VBR traffic models. Our work focused on the performance analysis of CBR, VBR and TCP traffic models on MANET and VANET networks using DSR protocol.

DYNAMIC SOURCE ROUTING PROTOCOL

Dynamic Source Routing (DSR) is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes which operate entirely on demand, and works on two mechanisms i.e. route discovery and route maintenance. The route discovery is initiated if and only if the routes to destinations are not known, for which it initiates a route discovery by sending a route request (RREQ) to all its neighbouring nodes containing the IP address of both sender and receiver in the packet header allowing the routing packet overhead of DSR to scale automatically to only what is needed to react to changes in the routes currently in use (Broach *et al.,* 1998*)*. Performance evaluation conducted on both proactive and on demand protocols by Qasim *et al.* (2009*)*, Kumar *et al.* (2008), and Raju and Mungara (2010) showed that DSR performed better than AODV and other proactive protocols in terms of throughput, less end-to-end delay, as well as less packets drop. The DSR performance was attributed to its characteristics of having multiple routes to other destination. In case of link failure, it does not require a new route discovery processes. Because of this, end-to-end delay is reduced as well as less packet dropping. Hence, the DSR protocol was chosen as genial candidate for carrying out further research

BACKGROUND OF THE STUDY

Various on demand, proactive and hybrid ad hoc routing protocols have been studied analytically and simulation method using TCP (Transmission Control Protocol), CBR (Constant Bit Rate) and VBR (Variable Bit Rate) traffic models (Rajago-